SYNOPSIS

FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN GEOGRAPHY

Ph.D. Thesis entitle

SUSTAINABLE AGRICULTURAL DEVELOPMENT OF KASARAGOD DISTRICT, KERALA: A GEOGRAPHICAL ANALYSIS

POST GRADUATE DEPARTMENT OF STUDIES AND RESEARCH IN GEOGRAPHY
MANGALORE UNIVERSITY
MANGALAGANGOTHRI-574199
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Ph.D. Final Thesis SYNOPSIS

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CERTIFICATE

This is to certify that the thesis entitled **"SUSTAINABLE AGRICULTURAL DEVELOPMENT OF KASARAGOD DISTRICT, KERALA: A GEOGRAPHICAL ANALYSIS"** submitted by **ANUSREE M.** for the award of the degree of **DOCTOR OF PHILOSOPHY** in Geography, is the original work carried out in the Department of Geography, Mangalore University, Mangalagangothri, under my guidance and supervision. This thesis has not formed the basis fully (or) partially for the award of any degree, diploma, or other similar titles earlier and no part of the thesis has been published or sent for publication at the time of submission.

Dr. DASHARATHA P. ANGADI
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DECLARATION

I hereby declare that the thesis entitled **"SUSTAINABLE AGRICULTURAL DEVELOPMENT OF KASARAGOD DISTRICT, KERALA: A GEOGRAPHICAL ANALYSIS"** submitted by me for the award of the degree of **DOCTOR OF PHILOSOPHY** in Geography, is the original work carried out in the Department of Geography, Mangalore University, Mangalagangothri, under the guidance and supervision of **DR. DASHARATHA P. ANGADI,** Associate Professor & Co-ordinator, Department of Geography Mangalore University, Mangalagangothri, and that the thesis has not previously formed the basis for the award of any degree, diploma, or other similar titles in this university or any other universities.

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SUSTAINABLE AGRICULTURAL DEVELOPMENT OF KASARAGOD DISTRICT, KERALA: A GEOGRAPHICAL ANALYSIS

INTRODUCTION:

Agriculture is regarded as a very important process in the world. Every man and his life is, directly and indirectly, connected with agriculture. Agriculture plays an important role in economic development, such as the provision of food to the nation, enlarging exports, transfer of manpower to non-agricultural sectors, contributing to capital formation, and securing markets for industrialization. Sustainable development is very important as the word agriculture. There are many definitions of scholars for the term "sustainable development". The Butland Report is an irrevocable report when using this term. Because of this one report, all the concepts of the process have evolved over the process

The term agriculture can be interpreted in many ways. Over the decades after the linkage between agriculture and human origin, more and more farmers are dependent on agriculture only for commercial purposes. In the first phase, he found food for himself before living in a single place through hunting, fishing, and gathering. In the Neolithic Period, they began to find food to get out of the caves. The Middle East countries were the first to cultivate and grow animals if they checked the history of agriculture. In 7000 BC America, Thailand, Mexico, north and Sothern parts of Asia started to cultivate different types of crops. Since then, it has been found that not only food products but also a wide variety of by-products. Traditional industries that are found today are largely dependent on agriculture. That is, the production of a country and a variety of products are factors that influence the growth of that country. Thus, the word "agriculture" has a great influence on the country's growth.

A process known as agriculture depends on several factors. On the other hand, agriculture is possible only through the influence of many factors. These factors can mean geographical factors, political or economic factors. A farmer is dependent on such things. Therefore, often the loss or progress of agriculture is due to the availability of these components or the shortage of these components.

Sustainable development has been defined in a variety of ways, but in practice, it has three dimensions – economic, environmental, and social. The word “sustainability” has become a global buzzword as a potential solution for many international, regional, and local

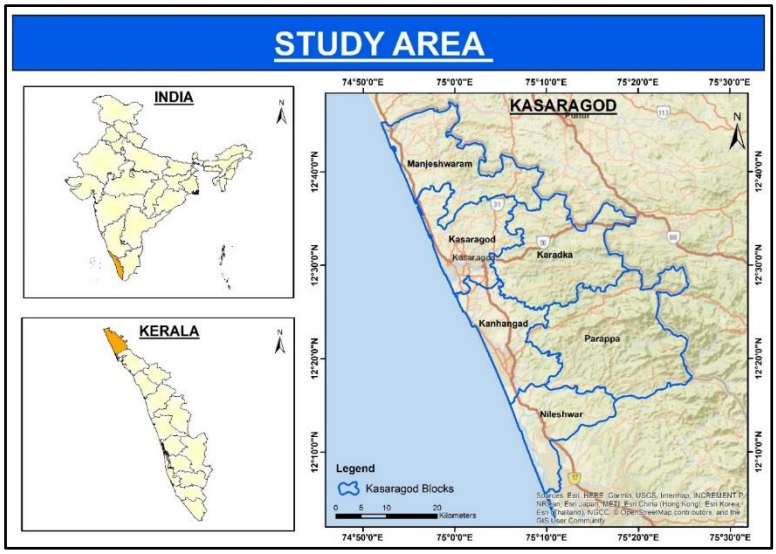
problems facing society today: Overpopulation, diseases, political conflicts, infrastructure deterioration, pollution, and unlimited urban expansion under limited resources availability. Regions' development is usually defined as the integral community development (social, economic, environmental and healthcare, technological, cultural, and recreational) on a particular territory. Region's development must be based on their optimal expansion constituents (social, natural, and economic development aspects) aimed at certain life's level maintenance and quality improvement through the mentioned constituents. (Jovovic, 2017). Sustainable development is fundamentally based on three pillars Environmental Sustainability, Social Sustainability, and Economic Sustainability. Environmental sustainability is the human beings are dependent on the resources around them. None of the resources found in the surroundings were distributed equally. All kinds of resources are being used as needed. If they start using them too much, then the next human community will have nothing to do with it. This means using the products in the environment properly. The implication is that natural resources must be harvested no faster than they can be regenerated while waste must be emitted no faster than they can be assimilated by the environment. ((DISENOF, 2000)

The present study examines sustainable agriculture and its development in the Kasaragod district. Sustainable agriculture development is very important for the future generation, and food security. The results of the study will give a reasonable understanding of the agricultural development of the Kasaragod district and how this development helps the sustainability of a particular area. The study will help to address issues in the agriculture sector, factors affecting agricultural development, agriculture scenario of the Kasaragod district.

STUDY AREA

Kasaragod District has been formed by carving out Kasaragod and Hosdurg Taluks of erstwhile Kannur district. Thus, the Kasaragod district happened to be the fourteenth district of the State. The district is bounded by the east by the Western Ghats, in the west by the Arabian Sea, in the north by the Dakshin Kannada district of Karnataka and in the South by the Kannur district. Kasaragod district lies between 11°.18' and 12°.48' north latitudes and between 74 º.52' and 75º.26' east longitudes. Kasaragod District has an area of about 1989 sq. km.

Figure No:1 Location map of the study area



OBJECTIVES OF THE STUDY

1) To analyze the geographical personality of the study area.

   - To study the important physical factors influencing sustainable agriculture development in the study area
   - To discuss the influence of the non-physical factors especially demography, literacy, and transportation on agriculture development.

2) To know the spatiotemporal changes of land use and land cover in the district.

   - To study the Spatio-temporal changes in LULC from 1991-2021
   - To analyze the transformation of agricultural land to built-up land in the period of 30 years.

3) To examine the agricultural scenario of the Kasaragod district

   - To examine the crop combination of the district by J.C.Weavers and Doi's crop combination method
   - To analyze the crop concentration by using the locational co-efficient method of S.S Batia.

- To find crop diversity of the study area by Harfindhal index

4) To analyze the sustainable agricultural development of the district

- To discuss the cropping pattern of the Kasaragod district by using agricultural statistics

- To analyze the sustainability of each crop for the food security of the district and

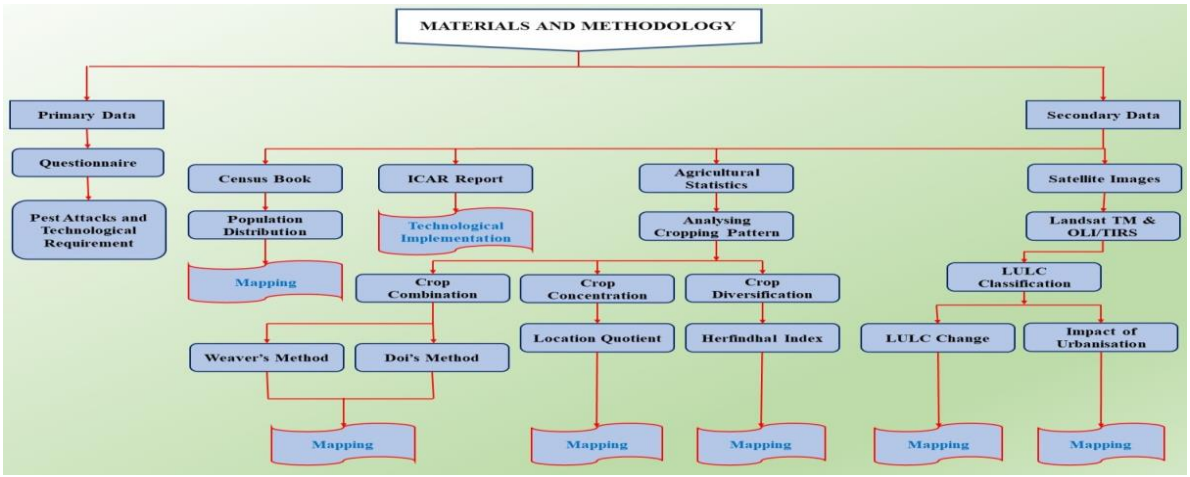
5) To identify the major problems of the agriculture sector in Kasargod district. And to find out the recommendations for sustainable agriculture.

ORGANIZATIONS OF THESIS CHAPTERS:

CHAPTER I: Sustainable agriculture development: An overview.

The chapter begins with a general introduction to agriculture and sustainable development. It also gives an overview of World agriculture, Indian agriculture, and Kerala agriculture. This chapter also includes a selection of s study areas, objectives, methodology, the relevance of the study, organization of thesis, and literature review carried out to define the specific research problem decisively.

METHODOLOGY



CHAPTER II: Geographical personality of the study area

Chapter II deals with all physical, and demographic characteristics of the study area. And it included the location of the study area on a map. And it describes physical settings like geomorphology, geology, soil, and climate with maps. The chapter explainsDemography, literacy, and transportation in the study area

Sustainable agriculture development is possible only because of well-balanced combinations of physical and non-physical elements, mainly demographic factors. which are held together to create steady agriculture. Physical features include geomorphology, geology, climate, soil, and availability of water resources. Non-physical factors, population, working population, occupational structure, literacy, animal distribution transportation, are taken.

Here, low land, middle land, and high land areas have been seen. The low land and middle land areas are sand and alluvium deposits found in this district. Most of the paddy fields and coconut plantations are concentrated in these areas. Nowadays, coconut plantation is increasing in the Kasaragod district. Paddy fields are converting for other crops. The upper land area covered rubber plantations, because of the presence of laterite soil, coconut, and arecanut also seen in this region. All crops depend on the southwest monsoon and for irrigational purposes the farmers are also using some facilities. Here, topography and climatic conditions are favorable for plantation agriculture, and the farmers are concentrating on this type of crop. There is always a need for adopting new policies on agriculture to ensure agricultural development from subsistence farming to commercial farming. The traditional cultivation of land can be altered by implementing programs of new technology, land reforms, and importing scientific knowledge to the farmers. The credit cooperative societies and the co-operative bank also play an important role in agricultural development by releasing loans to small farmers at low interest.

CHAPTER III: Spatio-temporal land use and land cover change

This chapter deals with the spatiotemporal changes in land use land cover of the study area. In this study, the LULC data set was created using time-series Landsat imageries for about 30 years from 1991 to 2021 for the Kasaragod district of Kerala, India. The study adopted a combination of remote sensing and GIS methods to quantitatively characterize the

LULC change of the study area. There is some fluctuation in the land use and land cover from 1991 to 2021.

Figure No: 2 Land use land cover change 1991-2021

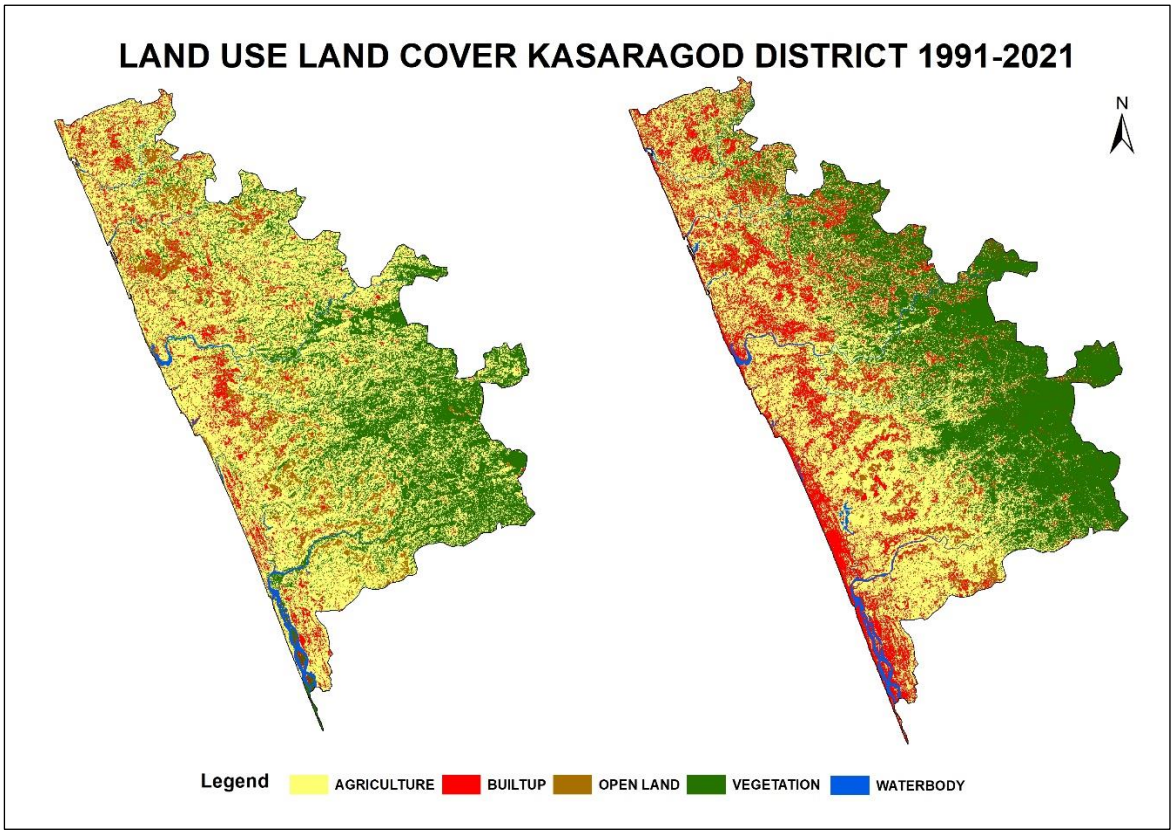


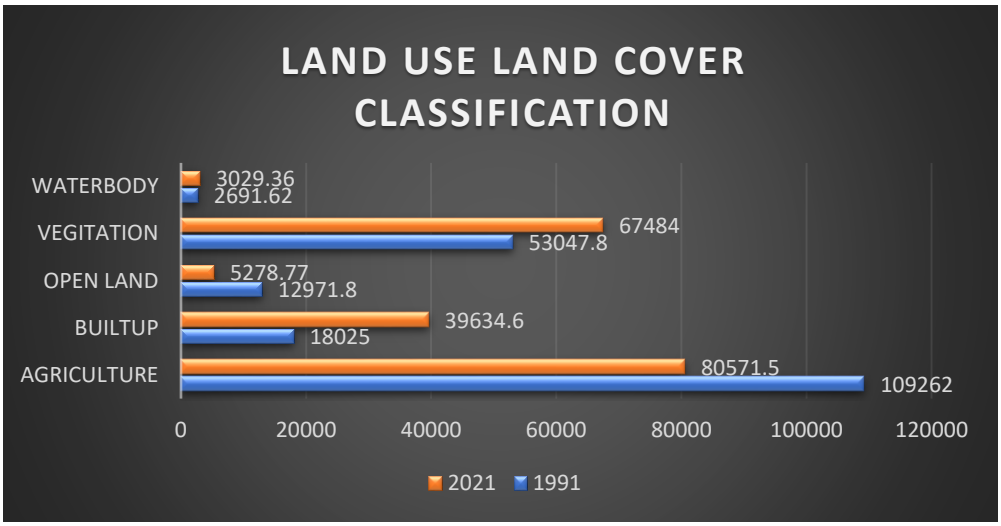
Table No: 1 Comparing statistics of LULC of the year 1991 and 2021

(Area in hectares)

Land use	1991	2021	Changes
Agricultural land	109262 (56.7%)	80571.5 (41%)	28690.5 (-15%)
Built-up land	18025 (9.19%)	39634.6(20%)	21609.9 (+11%)
Vegetation	53047.8 (27%)	67484 (34%)	7693.03(+7%)
Open land	12971.8 (7%)	5278.77 (3%)	14436.2 (-4%)
Water bodies	2691.62 (1%)	3029.36 (2%)	337.74 (+1%)

(***Source: Compiled by research scholar)***

Figure NO: 3 Land use land cover change



When analyzing the land use classification of Kasaragod district, agricultural land use changed into other land-use types such as vegetation, open land, and built-up land. The face of the transition from rural to urban structure can be seen. Well, connected transportation and roads can see in Kasaragod. As part of urbanization, some open spaces are emerging in this area, like parks, playgrounds, etc. The farmers of the Kasaragod district are concentrating on plantation agriculture. So, they are utilizing this area for commercial crops rather than food crops. In essence, the outcomes of this study signify greater importance to sustainable planning and policies for better management of the Kasaragod district.

CHAPTER IV: Crop combination, Crop concentration, and Crop diversity

Crop combination, crop concentration, and crop diversity are important techniques in agricultural geography. In this study period mainly ten crops area grown in the Kasaragod district. Cropping patterns help us to know about the major crops of the study area and how the area under each crop is changing yearly. So, this study discusses what food crops, commercial crops, and fruits and vegetables have seen in this area. The food crop, mainly area under paddy decreasing, and area under coconut and arecanut like commercial plantation increasing.

Table No: 2 Blockwise crops and area in hectares

(Area in hectares)

Crops	Kasaragod	Manjeshwar	Karadukka	Parappa	Kanhangad	Nileshwer
Paddy	217.6 *(1.75%)*	412.99 *(2.05%)*	215.03 *(1.02%)*	65.8 *(0.30%)*	420.24 (*2.39%)*	573.54 (*4.41%)*
Spices	340.65 (*2.74%)*	244.27 *(1.21%)*	1188.11 *(5.67%)*	943.75 *(4.40%)*	248.69 (*1.41%)*	371.18 (*2.85%)*
Fruits	1031.04 *(8.29%)*	1520.65 *(7.57%)*	12353.63 *(59.02%)*	2019.91 *(9.42%)*	1386.64 (*7.91%)*	2189.63 (*16.84%)*
Tubers	9.59 *(0.07%)*	10.07 *(0.05%)*	67.88 *(0.32%)*	379.47 *(1.77%)*	54.21 (*0.30%)*	47.21 (*0.36%)*
Vegetables	149.45 (*1.20%)*	178.75 (*0.89%)*	187.44 *(0.89%)*	369.18 *(1.73%)*	2013.59 (*11.49%)*	147.73 (*1.13%)*
Coconut	9681.95 *(77%)*	10831.93 (*53%)*	9623.53 *(45.98%)*	11788.15 *(55%)*	10949.44 (*62.49%)*	8491.28 *(65.34%)*
Cocoa	35.9 *(0.2%)*	76.33 *(0.38%)*	97.05 *(0.46%)*	70.78 *(0.33%)*	0.47 *(0.002%)*	0.06 *(0.004%)*
Teak	69.9 (*0.56%)*	108.21 *(0.53%)*	92.38 *(0.44)*	214.26 *(0.99%)*	54.77 (*0.31%)*	69.07 *(0.53%)*
Cashew	616.9 (*4.96%)*	1453.65 *(7.24%)*	2079.51 *(9.93%)*	1209.22 *(5.64%)*	1134.67 (*6.47%)*	475.83 *(3.33%)*
Arecanut	2711.26 (*21.8%)*	5231.05 *(26.06%)*	6142.66 *(29.34%)*	4363.23 *(20.36%)*	1259.1 (*7.18%)*	629.52 *(4.84%)*

(Source: Economics and Statistics department, 2018-2019)

The crops in the Kasargod district are classified into food crops, pulses, sugar crops, commercial crops, fiber drugs, oilseeds, vegetables, fruits, and plantation crops. Different variety of crops is cultivated all over the district. Table 1 shows the major crops of the Kasargod district. The farmers mainly focusing commercial crops, plantation crops, vegetables, and fresh fruits

Table No: 3. Crop combination by J.C.Weaver method

BLOCKS	2010-2011		2018-2019	
	No. of crop combination	**Crops**	**No. of crop combination**	**Crops**
Kasaragod	Two Crop	Coconut, Arecanut	Three Crop	Vegetables Fruits, Tubers
Manjeshwar	Two Crop	Coconut, Arecanut	Three Crop	Vegetables Fruits, Tubers
Kanhangad	Mono crop	Coconut	Three Crop	Vegetables Fruits, Tubers
Nileshwer	Mono crop	Coconut	Three Crop	Vegetables Fruits Tubers
Karadukka	Two Crop	Coconut, Arecanut	Three Crop	Vegetables Fruits, Tubers
Parappa	Ten Crop	Coconut, Arecanut, Cashew, spices, fruits, vegetables paddy, teak, tubers, cocoa	Three Crop	Vegetables Fruits, Tubers

The above table (No.3) shows the crop combination analysis, as per the weaver's method, the district exhibits monoculture to ten crop combinations. It can be noted that the combination of crops is mainly two crop combinations and three crop combinations.

Table No: 4 Crop combination by Doi's method

BLOCKS	2010-2011		2018-2019	
	No. of crop combination	**Crops**	**No. of crop combination**	**Crops**
Kasaragod	Two Crop	Coconut, Arecanut	Three Crop	Vegetables Fruits,
Manjeshwar	Two Crop	Coconut, Arecanut	Two Crop	Vegetables Fruits,
Kanhangad	Two Crop	Coconut Arecanut	Two Crop	Vegetables Fruits,
Nileshwer	Two Crop	Coconut Arecanut	Two Crop	Vegetables Fruits
Karadukka	Two Crop	Coconut, Arecanut	Two Crop	Vegetables Fruits,
Parappa	Two Crop	Coconut, Arecanut,	Two Crop	Vegetables Fruits,

The above Table No (4) shows the crop combination of analysis of Kasaragod district using Doi's method. According to this study, all the blocks have a combination of commercial crops. As per Doi's method, two crops and, three crop combinations have been seen.

The crop concentration study helps us to know which are the blocks that can be affected by degradation of the soil ecology and how changing the range of concentration can reduce it. There is a need to identify crops and varieties that may suit a range of environments and farmers' preferences.

The study examines the crop concentration of the Kasaragod district based on statistical data. During 2010-2011, the Kanhangad block had a high concentration of paddy and a low concentration have seen in the Nileshwer block. In 2018-2019, again Nileshwer block had a high concentration of paddy. Low concentration has been seen in the Parappa block. The high concentration of paddy was in Kanhangad and a low concentration was found in the Karadukka block during 2010-2011. In 2010-2011, cocoa concentration was mainly found in Manjeshwar. During 2018-2019 Manjeshwar continued the high concentration. 2010-2011, a high concentration of teak was found in Parappa and Manjeshwar. Very low concentration was found in Kanhangad and Kasaragod. In 2010-2011, a high concentration of cashew was found in Manjeshwar and Karadukka. During 2018-2019, high concentration was found in Karadukka and low concentration was found in Kasaragod, Kanhangad, Parappa, and Nileshwer. During 2010-2011, Manjeshwar and Karadukka had a high concentration of arecanut and low concentrations have been seen in Nileshwer and Kanhangad blocks. In 2018-2019, the Manjeshwar block had a high concentration of paddy. Low concentration has been seen in Kasaragod, Nileshwer, Kanhangad, and Parappa. The moderate concentration was found in Karadukka. During 2010-11, Parappa and Karadukka had a high concentration of spices and low concentration have seen in Kasaragod. In 2018-2019, again Manjeshwar block had a high concentration of spices. Low concentration has been seen in Kasaragod, Nileshwer, Kanhangad, and Parappa. During 2010-2011 Parappa, Nileshwer, and Kasaragod had a high concentration of fruits and a low concentration have seen in Kanhangad. In 2018-2019, the Manjeshwar block had a high concentration of fruits. Low concentration has been seen in Kasaragod, Nileshwer, Kanhangad, and Parappa. During 2010-11, Parappa, Nileshwer had a high concentration of vegetables and low concentration have seen in Karadukka and Manjeshwar. In 2018-2019, the Manjeshwar block had a high

concentration of vegetables. Low concentration has been seen in Kasaragod, Nileshwer, Kanhangad, and Parappa

Crop diversification provides better conditions for food security and enables farmers to grow surplus products for sale at the market and thus helping to obtain increased income to meet other needs related to household well-being. In the study period diversification of crops differs from one year to another year. Each period displays low, moderate, and high diversification. As per statistics, there is no uniformity in crop diversification. There were radical variations that occurred Kasaragod district. During 2010-2011, high diversification has seen Manjeshwar and Kanhangad, moderate diversification was found in Kasargod and Nileshwer. And low diversification was found in Karadukka and Parappa. In 2018-2019, a high was found in Karadukka, and no low diversification was noticed in this period. The remaining blocks noticed moderate diversification.

CHAPTER V: Agriculture development and its sustainability

The chapter examines the sustainability of food crops, commercial crops, spices, vegetables, and fruits of the Kasaragod district. While analyzing the agriculture development, the district is facing some serious issues. These problems slow down the agricultural development of the region. There is a collective tendency among the farmers for land change for cash crops, particularly rubber, to substitute for food crops. The unscientific practice of the pesticide endosulfan in the cashew plantations in the district-owned by the Plantation Corporation of Kerala and the consequential health problems and illnesses detected among the local population have been attracting media consideration for the last few years. There is an increasing tendency among farmers of the district to implement organic farming practices. But, the unavailability of the package of methods suggested for organic farming for the crops cultivated in the district is a limitation experienced by farmers.

CHAPTER VIII: CONCLUSION

A comprehensive conclusion and summary of the entire investigations carried out in the present study and the future scope is presented in this chapter. The conclusion chapter provides the sum up of all chapters together and presents the findings of the output and recommendations for sustainable agricultural development.

BIBLIOGRAPHY:

1. A.C.Hildarth (1941), "Effects of climatic factors on showing plant."
2. Amruth. M (2004), "Forest – agriculture linkage and its implication on forest management: A study of Delampady panchayath, Kasargod district. Discussion paper, Kerala research program local level development, Centre for development studies, Thiruvananthapuram.
3. Andrrzejczyzealski and et.al (2015), "Specialization and diversification of agriculture production in the light of sustainable development." Journal of international studies volume-8 , No: 2 (63-73pp)
4. AnirbenMukopadhyay (2013), "Spatio-temporal analysis of land use land cover change in Delhi using remote sensing and GIS techniques." International journal of geometrics and geosciences, volume-4, No: 4.
5. Anselam .A and et.al (2010), "Challenges of agriculture adaption to climate change in Nigeeria: a synthesis from the literature." The journal of field action, volume -4
6. Ashok senguptha and Devika sonwani (2012), "Sustainable development in India with references to agriculture sector". International journal of emerging research in management and technology", December.
7. Ashish kothari, "Development and ecological sustainability in India, possibilities for the post 2015 framework." Published by Oxfam India.
8. BahraHajirostamlo and et.al (2015), "The role of research and development in agriculture and its dependent concepts in agriculture". Asian journal of applied science and engineering, volume-4, No:1,issue-10
9. Barry Dalal, Clayton and Stephen Bass, "Sustainable development strategies, a resource book. Earthscan publication Ltd.
10. Beian Robert and Trevor Kanalay, "Urbanization and sustainability in Asia- case studiees of good practice.
11. Bindish. V, "Growth in agricultural productivity in India; 1956/57 to 1981/82.
12. B.M.Kumar (2005), "Land use in Kerala: changing scenario and shifting paradigms". Journal of tropical agriculture, volume-42(1-2), (1-12pp)
13. Bosshaq and et.al (2012), "Measuring indicators and determining factors affecting sustainable agriculture development in rural areas, a case study of Ravansar, Iran". International journal of agriculture science, volume-2(6),(550-551pp)
14. Brinda. B. Lin (2011), "Resilience in agriculture through crop diversification: adaptive manegement for environment change". Bioscience, volume-61, March.

15. CelalettinDvean and et.al (2012), “Effects of urbanization on agriculture lands and river basin: case study of Mersin (South Koria). Journal of environmental biology, volume-33,(363-371pp)
16. C.J. Barrow, “Environmental management for sustainable development.” 2nd Edition, Routledge.
17. Christepher Bryant, “The impact of urbanization and rural land use”. The role of food, agriculture, forestry and fisheries in human nutrition, volume-3.
18. Christensen. L. R (1975), “Concept and measurement of agricultural productivity”. American journal of agricultural economics, volume-57(5), (910-915pp).
19. C. Ramaswamy (2004), “Constraints to growth in Indian agriculture needed resource management and trade strategies.” Indian journal of agriculture economics, volume-59, No: 1, January-March.
20. C. W. Finkl and R.H.Chales, “Sustainability of subtropical coastal zones in south-eastern Florida: challenges for urbanized coastal environments threatened by development pollution, water supply and storm hazards”. Journal of coastal research, volume-19, (934-943pp).
21. Dariusekusz (2014), “Modernization of agriculture and its benefit V/S sustainable agriculture.” Economic engineering in agricultural and rural development, volume-14, issue-1
22. Das gupthaBiplab (1980), “The new agration technology and India”. Mac Million company of India.
23. Dasharatha P. Angadi (2002),“Spatio-temporal analysis of agricultural landuse in Belgaum District: A geographical probe”.
24. Dasharatha prasad and Suresh pal, “Agricultural technologies for rice –wheat cropping system in India”.
25. David Grigg, “An introduction to agricultural geography”,2nd edition, Newyork-London
26. D. E. Beker, “Agricultural regions of North America”. Ecogeography, volume-2, (452,493).
27. Di falco. S and Perrings. C. (2003), “Crop genetic diversity, productivity and stability of agro system. A theoretical and empirical investigation.” Scottish journal of political economy, volume-50, (207-216pp)
28. D. Narain (1977), “Growth of production in Indian agriculture.” Journal of agricultural economics, volume-32, January-March.
29. D. P. Rao (2000), “Role of remote sensing and geographic information system in sustainable development.” International achieves of photogrametry and remote sensing, volume-XXXIII, part B-7, Amsterdam.
30. Dr. D. Kumudha (2012), “Agricultural development in India – An overview.” International journal of science and research.
31. Dr.Hasendes raj goutham and Rohith ashwkeemar (2014), “The agriculture development – the road ahead.” Kurukshethra, volume-62, No:8
32. Dr. M. S. Deshmukh and Nitin A Baber, “Can organic farming contribute to sustainable agricultural development.” South Asian journal of multidisciplinary studies, volume-2, issue-4.

33. Dr. Praveen kumar, “Technologies to boost agricultural production”.
34. Dr. William. C. Motes, “Modern agriculture and its benefits-trends, implications, and outlook.”Pre-publication draft, 3-16-10.
35. Dumanski (1994), “Workshop summary, Proc. International workshop on sustainable development for the 21st century.” Volume-I, Agricultural Institute of Canada.
36. D. W. Harvey (1966), “Theoretical concept and the analysis of agricultural land use pattern in geography.” Annals of association of American geographers, volume-56(370).
37. D. W. Reevees (1997), “The role of soil organic matter in maintaining soil quality in continuous cropping system.” Soil and tillage research, volume-43, (131-167pp)
38. D. Whittesley, “Major agricultural regions of the earth”. Annals of association of American geographers, volume-26, (187-191pp).
39. E. Dayal, “Some aspects of agricultural geography of Punjab plain.”
40. Environmental indicators for agricultural concepts and framework, volume-1.
41. Etim. N. E and Dukiya. J. J. (2013), “GIS analysis of peri-urban agricultural land encrochment in Nigeeria.” International journal of advanced remote sensing and GIS, volume-2, issue-1, (303-315 pp)
42. Farshad. A and Zink. J. A (1989), “Seeking agriculture sustainability”. Agricultural ecosytsem and environment, volume-47, (1-12 pp)
43. Francis zanaNaab and et.al (2013), “Urbanization and its impact on agricultural lands in growing cities in developing countries: A case study of Themale in Ghana.” Modern science journal, volume-2, No: 2.
44. Frederick Musisi Kabuye (2008), “Agriculture development in east Africa”. Conference on sustainable agriculture development, 4th Asian conference on development, November.
45. Frederic Ebert Allen and Dag HammaskoidWeg, “Sustainable smallholder agriculture, good practices. DuetscheGesellschart for international Zusammenarbert (GIZ) publication, Germany.
46. Gallopin. G. C (1996), “Environmental and sustainability indicators and concepts of situational indicators- A system approach.” Environmental modelling and assessment-1 (101-117 pp)
47. Gollin. G. S and R. Rogerson (2002), “The role of agriculture on development.” American economic review, volume-92(2), (160-164pp)
48. Gordon clerk (1984), “The meaning of agricultural regions”. Scottish geographical magazine, volume-100(34)
49. GovindhanParayil (1996), “The Kerala model of development; development and sustainability in the 3rd world.” Third world quarterly, volume-17, No: 5, (941-957pp).
50. G. S. Balla and G. Singh (1997), “Recent development in Indian agriculture; a state level analysis.” Economic and political weekly, volume-32, No: 13, March-2 (A-2, A-18).
51. Haveni. H (1997), “Concepts of sustainable land management.” ITC journal 1997 ¾, special congress issue on geo-information for sustainable land management(SLM), (211-215 pp)

52. Hayomi. Y and V. M. Ruttan (1970), "Agricultural productivity difference among countries." American economic review, volume-6,(895-911pp)
53. H. F. Gregor (1970), "Geography of agricultural themes in research."
54. "Introductory agriculture", ICAR, e-course.
55. I. R. Bowler, "Promoting sustainable agriculture and rural development." Regional sustainable development review, Area studies, Europe.
56. Jabir singh and Dhellon. S. S (1984), "An agricultural geography of Hariyana." Kurukshethra, vishal publications.
57. J. C. Weaver, "Crop combination in the middle west." Geographical review, volume-44, No: 8, (175-200pp).
58. Jennifer A Elliott, "An introduction to sustainable development", 3rd edition.
59. J. Kostowick (1965), "Land utilization in east central Europe: case studies." Geographical polonica-5.
60. J. Liu and Deng X (2010), "Progress of the research methodologies on the temporal and social process." Chinees' bullettin, volume-55.
61. Joaquin Arias Segura, "The contribution of agriculture to sustainable development in America.
62. John. M. Kerr (1996), "Sustainable development of rain fed agriculture in India." EPTD discussion paper, Environment and production technology division, International food policy research institute, November.
63. John siraj and et.al, "Education for sustainable development in the early years."
64. J. S. Kanwar (1991), "Indian agriculture at cross roads-challenges and strategies." IASSI Quarterly, volume-9, No: 3, (1-18pp).
65. Jules pretty, "Sustainable agriculture and food." Earthscan referencecollation, volume-1.
66. J. W. Brinch (1954), "Observation on the delimitation of farming type region." British geographers Trans and paper, volume-2, (141-158pp).
67. K. Alam, "Agricultural development in North-Eastern India constrains and prospects."
68. Kekana Maruthi Arjun (2013), "Indian agriculture-status, importance, and role in Indian economy." International journal of agricultural and food science technology, volume-4, No:4 (343-346pp).
69. Khoshoo (1986), "Environmental priorities in India and sustainable development." Indian science congress association, volume-11.
70. K. H. W. Klager (1958), "Ecological crop geography."
71. K. Kareemulla and et.al (2017),"An agriculture of sustainable development of India." Current science, volume-112, No: 2, January.

LIST OF PUBLICATIONS OF THE AUTHOR

In Journals/ Proceedings:

- **Title of the paper: "**Changing scenario of cropping pattern in Kasaragod district: A geographical study".**Journal name:** Thematic Journal of Geography (UGC care list Journal)Volume 8 Number 4 October 2019. **ISSN: 2277-2995**
- **Title of the paper: "**Paddy Cultivation, its varieties and farming methods in Kasaragod district, Kerala: A Geographical Approach".**Journal name:** Desh Vikas (peer-reviewed) Volume 8 Issue: 3 October – December 2021. **ISSN:** 2394 -1782
- **Title of the paper:** An analysis of drinking water quality, selected delineating water sources of Kozhikode Corporation, Kerala, **Journal name:** Geo eye (Refereed Journal). **ISSN: 2347-4246**

PAPER IN COMMUNICATION STAGE

- Research paper sent for publication to **NAGI Annals** (UGC CARE LISTED JOURNAL) entitled "Detecting LULC change of Kasaragod district: a geographical analysis", dated: 15/07/2021.**ISSN: 0970-972X**
- Research paper sent for publication to **GEOGRAPHICAL ANALYSIS**, peer reviewed journal, Dept. of geography, Bangalore university entitled **"**an analysis of lulc changes of Kasaragod block, Kerala: using geospatial technology", dated: 23/12/2021

PRESENTATION DETAILS:

- Presented paper entitled ***"Spatial analysis of land use and land cover of Kasaragod district, Kerala: using GIS"***at 41st Indian Geography Congress by Dept of Applied

Geography, Doctor HarisingGour Vishwavidyalaya, Sagar, MP on 28-30 December 2019.

- Presented a paper on *"**Sustainable Paddy Cultivation, its varieties and farming methods in Kasaragod district, Kerala: A Geographical Approach***" in the IGS - International E-Conference on "EARTH SCIENCES AND SUSTAINABLE DEVELOPMENT GOALS" Conducted from 5th to7th August 2021 by Dept of Geography, Osmania University, Hyderabad, Telangana in Collaboration with the Indian Geographical Society, Chennai.
- Presented paper entitled ***"An analysis of LULC changes of Kasaragod block, Kerala: using geospatial technology"*** 43rd Indian Geography Congress to be held atBanaras Hindu University, Varanasi from 28-30 October 2021

ATTENDED:

- Attended international webinar on ***"Geospatial technology for sustainable development"*** by the department of studies in Geography, the University of Mysore on 5th and 6th February 2021.
- Participated in a national webinar on "***Climate change, Agriculture and disaster management-geospatial remedy"*** conducted by the department of geography, Mangalore University on 25th and 26th February. And I worked as a member of the organizing committee.
- Participated in the National Webinar on***"Tourism in India: Explore the Unexplored",*** organized by the Department of Geography in association with IQAC on 3rd of March, 2021
- Attended the webinar on ***'Groundwater Security of India',*** organized by the Faculty of Environmental Science (Dept. Of Chemistry), School of Basic and Applied Sciences, Adamas University dated 23.03.2021 on the occasion of World Water Day, 2021.
- Participated in National Level Webinar Conducted on 24th July 2021 on "***The Impact of Monsoon on Indian Agriculture***

- Participated in National Level Webinar Conducted on 27th July 2021 on "***Climate Change & Its Impact on Globalization".***
- Attended the Esri India User Conference on July 28-29, 2021

Dr. DASHARATHA P. ANGADI **ANUSREE M.**

(Research Guide) (Research Scholar)